

**REMARKS**

Claims 1, 2, and 4-26 are pending in the present application. In the Final Office Action mailed November 25, 2009, the Examiner rejected claims 20-23 under 35 U.S.C. §101 because the claimed invention is directed to non-statutory subject matter. The Examiner next rejected claims 1, 2, 4-12, 20-23, and 24-26 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. Claims 1, 2, 4-12, 20-23, and 24-26 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Claims 1, 2, 5-9, 13, 16-19, and 24-26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kruger (USP 6,216,025) in view of Bae et al. (US Pub. 2007/0140541). Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kruger in view of Bae et al. as applied to claim 1, and further in view of Takashima (JP363211879). Claims 10-12, 14, and 15 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kruger in view of Bae et al. as applied to claims 1 and 13, and further in view of Ben-Haim et al. (US Pub. 2002/0065455). Claims 20, 21, and 23 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kruger in view of Bae et al., and further in view of Ben-Haim et al. Claim 22 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kruger in view of Bae et al. as applied to claim 20, further in view of Ben-Haim et al., and further in view of Maas, III (USP 6,181,832).

**Rejection of claim 20 under §101 is improper and the Finality is premature.**

Claim 20 was rejected under 35 U.S.C. §101. This rejection is improper for procedural reasons, and the finality of this Office Action is therefore premature. Accordingly, Applicant has treated this Office Action as a non-final Office Action. Further, the rejection of claim 20 is deficient for substantive reasons as well, as discussed below, and Applicant requests withdrawal of the rejection thereof.

**The Finality of the Office Action issued November 25, 2009 is premature.**

Procedurally, the finality of the Office Action issued November 25, 2009 is premature. MPEP §706.07(a) states, "Under present practice, second or any subsequent actions on the merits shall be final, except where the examiner introduces a new ground of rejection that is neither necessitated by applicant's amendment of the claims...." *MPEP §706.07(a)* (emphasis added). In the present Office Action the Examiner rejected claim 20 under §101. And, although claim 20 was rejected under §101 in the previous Office Action issued May 27, 2009, such was based on other grounds, and the currently pending rejection under §101 was not necessitated by any

amendments to claims. As will be shown, the basis for the rejection in the Office Action dated May 27, 2009 were overcome by claim amendments, thus the current basis for the rejection of claim 20 under §101 is a new ground of rejection, and based on a preamble that has not been amended. Thus, the Finality of the current Office Action is premature.

In the Office Action issued May 27, 2009, the Examiner based the rejection on a judicial exception of §101, and alleged that the claim failed to produce a useful, concrete, and tangible result. *Office Action*, 05/27/09, pg. 3. Regarding the rejection in the May 27, 2009 Office Action, the Examiner further stated that the claim “does not require the step of reconstructing an image...” *Id.* In a Response dated July 23, 2009, Applicant amended claim 20 to call for, in part, a computer readable storage medium having a computer program stored thereon and representing a set of instructions that when executed by a computer causes the computer to generate an image using at least the TCT data determined from the coefficients. In the currently pending Office Action issued November 25, 2009, the Examiner did not address the merits of the previous rejection of claim 20 under §101. Thus, it is apparent that the claim amendments submitted in the Response dated July 23, 2009 overcame the rejection under §101. However, in the currently pending Office Action dated November 25, 2009, the Examiner issued another rejection under §101 – but this time based on an allegation that the “computer readable medium” can take both tangible forms and non-tangible forms and is thus broad enough to read on both a statutory and non-statutory embodiment. Thus, in the Office Action dated May 27, 2009, the rejection of claim 20 was based on claimed subject matter that failed to produce a useful, concrete, and tangible result, and the currently pending Office Action dated November 25, 2009 was based on aspects of the preamble as they relate to a computer readable storage medium and based on an allegation that the claim calls for material that can include both tangible and non-tangible forms. Nowhere has the preamble been amended. As such, the basis for the rejection is a new ground of rejection that was nowhere necessitated by any amendment of the claim. Thus, for this procedural reason the Finality is premature, and Applicant has treated this Office Action as a non-final Office Action.

The rejection of claim 20 under §101 is substantively lacking.

Substantively, the rejection of claim 20 is inadequate. Applicant requests withdrawal of the rejection of claim 20 under §101, and of the claims that depend therefrom.

Claim 20 calls for a computer readable storage medium having a computer program stored thereon and representing a set of instructions that when executed by a computer causes the computer to determine coefficients of a polynomial expression that is relative to a position of a

transducer about an imaging object, acquire thermoacoustic computed tomography (TCT) data from the imaging object, from the coefficients, determine TCT data corresponding to a desirable transducer location about the imaging object not accessible to a TCT transducer, and generate an image using at least the TCT data determined from the coefficients.

In the rejection the Examiner stated that “the state-of-the-art in the field of computer readable media suggests that such medium can take both tangible forms and non-tangible or transitory forms (such as signals and carrier waves).” *Office Action*, 11/25/09, pg. 2. “Since the broadest reasonable interpretation of the limitation ‘computer readable medium’ not only takes into account the disclosed invention but also the level of skill in the art, it would be reasonable to conclude in this case that the claim is broad enough to read on both a statutory and non-statutory embodiment.” *Id.* Applicant respectfully disagrees, as claim 20 is not directed toward non-statutory subject matter under any “broadest reasonable interpretation.”

Claim 20 does not call for a computer readable medium that can be construed as a “signal or a carrier wave.” Claim 20 calls for “a computer-readable medium having stored thereon a computer program....” Nowhere has the Examiner provided any explanation that justifies how a medium having something stored thereon is transitory and therefore non-statutory subject matter. One skilled in the art will readily appreciate that a computer readable storage medium having something stored thereon is a tangible and non-transitory medium. Having something stored “thereon” inherently implies a tangible medium that could not constitute a “carrier wave.” One skilled in the art would not state that something akin to a “carrier wave” would have something “stored thereon.”

The MPEP makes clear, “USPTO personnel must weigh the determinations made above to reach a conclusion as to whether it is more likely than not that the claimed invention as a whole either falls outside of one of the enumerated statutory classes or within one of the exceptions to statutory subject matter.” *MPEP §2106* (emphasis added). Thus, the claim must be considered as a whole, and in this case the overall phrase “computer-readable medium having stored thereon” must be given consideration.

As such, Applicant believes that the rejection of claim 20 under §101 is inadequate and requests withdrawal of the rejection thereof. The Examiner has provided no explanation as to how a medium having something stored thereon in any way falls under a category of a transitory “carrier wave.”

Additionally, claim 20 calls for, in part, a computer-readable medium having stored thereon a computer program which, when executed by a computer, will cause the computer to

generate an image. According to the MPEP §2106 and the Interim Guidelines related to Patent Subject Matter Eligibility (published by the US PTO on August 24, 2009) at pg. 8, subject matter eligibility under §101 begins with an inquiry as to whether the claim is a process, machine, manufacture, or composition of matter. If yes, then a next inquiry is whether the claim is a process. If not a process claim the inquiry is directed toward the judicially recognized exceptions (i.e., abstract idea, law of nature or natural phenomenon). If not one of the exceptions, then the material is deemed to be patentable subject matter. In this case, the claim is directed toward, in part, a computer-readable medium having stored thereon a computer program which, when executed by a computer, will cause the computer to generate an image. Thus, the claim is not directed toward one of the judicially recognized exceptions. The computer program called for is configured to generate an image that produces a useful, concrete, and tangible result. For this reason as well, Applicant believes claim 20 includes statutory subject matter.

Thus, Applicant requests withdrawal of the rejection of claim 20, and the claims that depend therefrom, under §101.

**Rejection of claims under §112, first paragraph have been overcome.**

Claims 1, 20, and 24 were rejected under §112, first paragraph for allegedly containing “subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.” *Office Action*, 11/25/09, pg. 3. Applicant respectfully disagrees.

Regarding claims 1 and 20, the Examiner alleged that the limitations as related to “access” and “accessed” cannot be found in the Specification. *Id.* However, although specific uses and variants of the word “access” are not included in the Specification, it is clear from the Specification that Applicant had possession of the claimed invention at the time the application was filed. The Specification teaches:

As described above, imaging bowl 22 is constructed to have a hemispherical shape. As such, transducers may only be positioned or integrally formed about the hemispherical surface of the imaging bowl. Accordingly, data may only be directly acquired from the imaging object at the several transducer locations along the hemispherical surface of the imaging bowl. As a result, it is not possible to directly acquire data from those portions of the imaging object that would correspond to transducer locations of the mirrored, albeit imaginary, portion of imaging bowl 22. As noted above, this lack of data acquisition may

affect the diagnostic value of the reconstructed image as well as the image's quality.

Accordingly, the present invention includes an imaging technique for deriving data that would otherwise have been acquired at inadmissible transducer locations. That is, the imaging technique is designed to derive the TCT data that cannot be readily acquired.

*Specification*, Pg. 9, Ins. 15-28.

In fact, the Specification is peppered throughout with references to acquisition of data from transducer locations that are inadmissible – or inaccessible. Thus, the claims as they were amended in the Response dated July 23, 2009 are supported in the Specification as filed. Nevertheless, in the interest of advancing prosecution, Applicant has amended claims 1 and 20. As such, claim 1 has been amended to call for, in part, a method of diagnostic imaging that includes the step of determining a second set of TCT data from the first set of TCT data for a second inadmissible measurement surface. Claim 20 has been amended to call for, in part, a computer readable storage medium having a computer program stored thereon and representing a set of instructions that when executed by a computer causes the computer to determine TCT data corresponding to a desirable transducer location about an imaging object that is inadmissible to a TCT transducer.

Regarding claim 24, Applicant submits that the amendments submitted in the Response dated July 23, 2009 are fully supported in the Specification. Claim 24 calls for, in part, a method of imaging a breast comprising the step of deriving a second TCT dataset from a first TCT dataset, the second dataset including data for transducer locations mirrored from a first set of transducer locations. In the Office Action dated November 25, 2009, the Examiner alleged “the limitation ‘mirrored’ is not supported by the Specifications [sic].” *Office Action*, 11/25/09, pg. 3. Applicant respectfully disagrees. Referring to the Specification at Pg. 9, Ins. 15-28, and as quoted above, the Specification clearly teaches it is not possible to directly acquire data from those portions of the imaging object that would correspond to transducer locations of a mirrored portion of imaging bowl 22. *Specification*, pg. 9, Ins. 19-21. Thus, the reference to transducer locations mirrored from a first set of transducer locations is explicitly set forth in the Specification.

Thus, because of the amendments submitted herein with respect to claims 1 and 20, and because the previously submitted amendments to claim 24 are fully supported by the Specification, Applicant requests withdrawal of the rejection of claims 1, 20, and 24 under §112, first paragraph, and of the claims that depend therefrom.

**Claim Rejections, §103**

Claims 1, 13, and 24 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kruger in view of Bae et al. Nowhere does Kruger, Bae et al., or any combination thereof teach or suggest that called for in claims 1, 13, and 24. In particular, nowhere does either reference, alone or in combination, teach or suggest determining a second set of TCT data from a first set of TCT data for a second inadmissible measurement surface as called for in claim 1. Nowhere does either reference, alone or in combination, teach or suggest a computer programmed to derive, from the acquired data, unacquired data for the imaging object for one or more locations inadmissible for sensor positioning due to a positioning of the imaging object as called for in claim 13. Nowhere does either reference, alone or in combination, teach or suggest deriving a second TCT dataset from a first TCT dataset, the second TCT dataset including data for transducer locations mirrored from the first set of transducer locations as called for in claim 24.

Kruger teaches specific arrangements of multiple transducers on a rotatable imaging bowl for measuring acoustic waves produced in tissue when the tissue is exposed to electromagnetic radiation. *Kruger*, Abstract. Kruger describes acoustic shielding techniques to minimize stray echoes and sources of noise, techniques for cancelling noise, modulation of the time between imaging pulses to randomize the effect of acoustic echoes, and a filtering technique applied to compensate for the frequency response of the transducers. *Id.*, Col. 3., lns. 15-26. “The aim is to reconstruct some property of the breast from an ensemble of pressure measurements made externally to the breast.” *Id.*, Col. 10, lns. 18-20. “An array of sixty-four acoustic transducers 33 is located within imaging bowl 14 in tank 16 [sic].” *Id.*, Col. 6, lns. 1-2. The transducers should be evenly spaced across the array, and are positioned in connection to Fig. 6. *Id.*, Col. 6, lns. 3-5.

Thus, Kruger teaches arrangements of transducers and techniques for measuring acoustic waves in tissue when the tissue is exposed to electromagnetic radiation.

Bae et al. is directed toward CT imaging, and at the cited location, Bae et al. teaches that “[t]he preferred slice thickness and reconstruction interval for the CT slices is 1 mm or less,” but the algorithm disclosed therein can accommodate different slice thicknesses and reconstruction intervals. *Bae et al.*, Para. [0054]. “After the boundary of the lung region is refined as described above in connection with FIG. 2, the 2D segmented lung regions can be stacked to generate a 3D volumetric data set of the lung region.” *Id.* “If the reconstruction interval is larger than 1 mm, finer-resolution slices can be interpolated at every 1 mm using the slice neighboring above and the slice neighboring below and integrated into the expanded 3D volumetric dataset.” *Id.*

Thus, Bae et al. teaches interpolation of CT data.

The combination of Kruger and Bac et al. does not result in the claimed subject matter. Kruger teaches an array of transducers that acquires data over a spherical surface, and Bac et al. teaches interpolation of data. In combination, Kruger and Bac et al. at most teach a system having an array of transducers (Kruger) and data interpolated between locations where transducers are placed (Bac et al.). In other words, Kruger teaches obtaining data at an array of locations surrounding the breast, and Bac et al. teaches interpolation of CT data to obtain finer resolution of slices. Thus, the combination would teach that higher resolution data may be obtained by first measuring breast imaging data at the 64 transducer locations of Kruger, and then interpolating between such locations, but at locations within the imaging bowl of Kruger, to obtain higher resolution data. Nowhere do any of these interpolation locations within the imaging bowl of Kruger, have anything to do with determining or deriving data that is at an inadmissible or mirrored location. Thus, nowhere does either reference, alone or in combination, teach or suggest that data may be extrapolated as alleged by the Examiner. In fact, the claims themselves do not even call for anything to do with extrapolation of data.

In the Response to Arguments in the Office Action dated November 25, 2009, the Examiner stated that the extrapolation as described in the application “would be enough for one of ordinary skill in the art to see that this aspect of the invention can be read on by either interpolation or extrapolation. *Office Action*, 11/25/09, pg. 9. The Examiner’s position is unsustainable, and Applicant requests withdrawal of the rejection of claims 1, 13, and 24 based on Kruger and Bac et al. Clearly extrapolation and interpolation encompass different mathematical techniques, and Bac et al. is directed specifically toward interpolation for the purpose of resolution improvement. One skilled in the art would not glean from the disclosure of Bac et al. that data can be extrapolated to generate data at inadmissible sensor locations, based on the teaching of Bac et al. of data interpolation.

In the Response to Arguments, the Examiner stated, “if one of ordinary skill in the art was to perform Bac et al.’s reconstruction interpolation on the TCT data taught by Kruger, there would be no doubt that the interpolation would generate data that corresponds to a portion of the measurement surface different from the first portion.” *Office Action*, 11/25/09, pg. 8. Applicant does not disagree with the Examiner in this statement. As summarized above, the combination of references teaches, at most, that higher resolution data may be obtained by first measuring breast imaging data at the 64 transducer locations of Kruger. The Examiner is correct – data obtained in such a fashion would indeed be on the measurement surface of Kruger, and not at an inadmissible or mirrored transducer location. Thus, nowhere does either reference teach or suggest anything to

do with determining data for an inadmissible or mirrored transducer location as called for in the claims.

The Examiner stated, “one would not perform interpolation for a portion of the measurement surface the same as the first portion.” *Id.* Applicant disagrees. Bac et al. teaches interpolation of data for the purpose of obtaining higher resolution data, and this has nothing to do with generation of data in an imaging location that is for an inadmissible or mirrored transducer location as called for in the claims.

The Examiner stated that “when an interpolation for reconstruction is conducted, it yields data for the areas in between the areas covered by existing data.” *Id.*, pgs. 8-9. Applicant does not disagree with this statement. Indeed, interpolation of Bac et al. does obtain data for areas between existing, or measured, locations. However, nowhere does Bac et al. teach or suggest anything to do with generation of data in an imaging location that is for an inadmissible or mirrored transducer location as called for in the claims.

Thus, that called for in claims 1, 13, and 24 is neither taught nor suggested in Kruger, Bac et al., or a combination thereof. Accordingly, Applicant believes that claims 1, 13, and 24, and the claims that depend therefrom, are patentable over the art of record.

Claim 20 was rejected under 35 U.S.C. §103(a) as being unpatentable over Kruger in view of Bac et al., and further in view of Ben-Haim et al. Claim 20 calls for, in part, a computer readable storage medium having a computer program stored thereon and representing a set of instructions that when executed by a computer causes the computer to determine coefficients of a polynomial expression that is relative to a position of a transducer about an imaging object, acquire thermoacoustic computed tomography (TCT) data from the imaging object, and from the coefficients, determine TCT data corresponding to a desirable transducer location about the imaging object that is inadmissible to a TCT transducer.

The Examiner relied on Ben-Haim et al. for teaching the use of a Legendre Polynomial, apparently relying on Kruger and Bac et al. for the remaining aspects of the claimed subject matter. Thus, specifically to claim 20, the Examiner has apparently relied on Ben-Haim et al. for teaching a computer caused to determine coefficients of a polynomial expression.

Ben-Haim teaches a locating system for determining the location and orientation of an invasive medical instrument relative to a reference frame. *Ben-Haim, Abstract*. The position and orientation of a distal end of a catheter are ascertained by use of two or three antennas, such as radiators 18, 20, and 22. *Id.*, Para. 103. The three radiators are driven by a radiator driver 24 and, along with a signal processor 26, provide “a display or other indication of the position and



orientation of the distal end 15 on a monitor 27.” *Id.*, Par. 105. “[T]he field equations are derived specifically for each embodiment and are dependent on the geometry and characteristics of the radiators.” *Id.*, Par. 147. In the preferred embodiment where the radiators are coils, for a coil with N turns, radius R, and current I, a series of vector equations are generated wherein a radial and tangential component are described. *Id.*, Pars. 147-148. The tangential component includes an expression,  $P_n(x)$ , which is a Legendre Polynomial of degree n which may be calculated recursively through the method described. *Id.*, Pars. 149-153. Thus, the field sensed by a remote sensor results in equations having known and unknown variables for any given coil. *Id.*, Pars. 154-155. In the embodiment having three sensors, the technique described results in an overdetermined series of nine equations and six variables and, with nine sensor readings, the unknowns may be numerically solved for by using, for instance, a Newton-Raphson method for non-linear systems, and “[t]he location sensor position and orientation are displayed on monitor 27.” *Id.*, Pars. 158-159.

Thus, Ben-Haim et al. describes obtaining a location and orientation of an invasive medical instrument using a numerical solution that includes a Legendre Polynomial.

As such, nowhere does Ben-Haim et al. teach or suggest determining TCT data corresponding to a transducer location about the imaging object not accessible to a TCT transducer. Nowhere does Kruger, Bae et al., or Ben-Haim et al., alone or in combination, teach or suggest that called for in claim 20. Although Ben-Haim et al. describes the use of a Legendre Polynomial, Ben-Haim et al. does not make up for the deficiencies of the other two references. Thus, nowhere does Kruger, Bae et al., Ben-Haim et al., or a combination thereof teach or suggest obtaining data that corresponds to a transducer location not accessible to a TCT transducer.

Further, nowhere do any of the references teach or suggest anything to do with determining data corresponding to a desirable transducer location about the imaging object that is inadmissible to a TCT transducer, as called for in claim 20.

Thus, that called for in claim 20 is neither taught nor suggested in Kruger, Bae et al., Ben-Haim et al., or a combination thereof. Accordingly, Applicant believes that claim 20 and the claims that depend therefrom, are patentable over the art of record.

Therefore, in light of at least the foregoing, Applicant respectfully believes that the present application is in condition for allowance. As a result, Applicant respectfully requests timely issuance of a Notice of Allowance for claims 1, 2, and 4-26.

Applicant appreciates the Examiner's consideration of these Amendments and Remarks and cordially invites the Examiner to call the undersigned, should the Examiner consider any matters unresolved.

Respectfully submitted,

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**General Authorization and Extension of Time**

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 07-0845. Should no proper payment be enclosed herewith, as by credit card authorization being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 07-0845. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extensions under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 07-0845. Please consider this a general authorization to charge any fee that is due in this case, if not otherwise timely paid, to Deposit Account No. 07-0845.

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